

ANNUAL REPORT
OF
THE DIRECTOR
OF THE
MUSEUM OF COMPARATIVE ZOOLOGY
AT HARVARD COLLEGE
TO THE
PRESIDENT AND FELLOWS OF HARVARD COLLEGE
FOR
1920-1921.

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1921.

REPORTS ON THE SCIENTIFIC RESULTS OF THE EXPEDITION TO THE EASTERN TROPICAL PACIFIC, IN CHARGE OF ALEXANDER AGASSIZ, BY THE U. S. FISH COMMISSION STEAMER "ALBATROSS," FROM OCTOBER, 1904, TO MARCH, 1905, LIEUTENANT COMMANDER L. M. GARRETT, U. S. N., COMMANDING, PUBLISHED OR IN PREPARATION:—

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| <p>A. AGASSIZ. V.⁵ General Report on the Expedition.</p> <p>A. AGASSIZ. I.¹ Three Letters to Geo. M. Bowers, U. S. Fish Comm.</p> <p>H. B. BIGELOW. XVI.¹⁶ The Medusae.</p> <p>H. B. BIGELOW. XXIII.²³ The Siphonophores.</p> <p>H. B. BIGELOW. XXVI.²⁶ The Ctenophores.</p> <p>R. P. BIGELOW. The Stomatopods.</p> <p>O. CARLGREN. The Actinaria.</p> <p>R. V. CHAMBERLIN. XXXI.³¹ The Annelids.</p> <p>H. L. CLARK. XXXIII.³³ The Holothurians.</p> <p>H. L. CLARK. XXXII.³² The Starfishes.</p> <p>H. L. CLARK. XXX.³⁰ The Ophiurans.</p> <p>S. F. CLARKE. VIII.⁸ The Hydroids.</p> <p>W. R. COE. The Nemerteans.</p> <p>L. J. COLE. XIX.¹⁹ The Pycnogonida.</p> <p>W. H. DALL. XIV.¹⁴ The Mollusks.</p> <p>C. R. EASTMAN. VII.⁷ The Sharks' Teeth.</p> <p>S. GARMAN. XII.¹² The Reptiles.</p> <p>H. J. HANSEN. The Cirripeds.</p> <p>H. J. HANSEN. XXVII.²⁷ The Schizopods.</p> <p>W. E. HOYLE. The Cephalopods.</p> <p>W. C. KENDALL and L. RADCLIFFE. XXV.²⁵ The Fishes.</p> | <p>C. A. KOFOID. III.³ IX.⁹ XX.²⁰ The Protozoa.</p> <p>C. A. KOFOID and J. R. MICHENER. XXII.²² The Protozoa.</p> <p>C. A. KOFOID and E. J. RIGDEN. XXIV.²⁴ The Protozoa.</p> <p>P. KRUMBACH. The Sagittae.</p> <p>R. VON LENDENFELD. XXI.²¹ The Siliceous Sponges.</p> <p>R. VON LENDENFELD. XXIX.²⁹ Hexactinellida.</p> <p>G. W. MÜLLER. The Ostracods.</p> <p>JOHN MURRAY and G. V. LEE. XVII.¹⁷ The Bottom Specimens.</p> <p>MARY J. RATHBUN. X.¹⁰ The Crustacea Decapoda.</p> <p>HARRIET RICHARDSON. II.² The Isopods.</p> <p>W. E. RITTER. IV.⁴ The Tunicates.</p> <p>G. O. SARS. The Copepods.</p> <p>F. E. SCHULZE. XI.¹¹ The Xenophyphoras.</p> <p>HARRIET R. SEARLE. XXVIII.²⁸ Isopods.</p> <p>H. R. SIMROTH. Pteropods, Heteropods.</p> <p>E. C. STARKS. XIII.¹³ Atelaxia.</p> <p>TH. STUDER. The Alcyonaria.</p> <p>JH. THIELE. XV.¹⁵ Bathysciadium.</p> <p>T. W. VAUGHAN. VI.⁶ The Corals.</p> <p>R. WOLTERECK. XVIII.¹⁸ The Amphipods.</p> |
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- ¹ Bull. M. C. Z., Vol. XLVI., No. 4, April, 1905, 22 pp.
- ² Bull. M. C. Z., Vol. XLVI., No. 6, July, 1905, 4 pp., 1 pl.
- ³ Bull. M. C. Z., Vol. XLVI., No. 9, September, 1905, 5 pp., 1 pl.
- ⁴ Bull. M. C. Z., Vol. XLVI., No. 13, January, 1906, 22 pp., 3 pls.
- ⁵ Mem. M. C. Z., Vol. XXXIII., January, 1906, 90 pp., 96 pls.
- ⁶ Bull. M. C. Z., Vol. L., No. 3, August, 1906, 14 pp., 10 pls.
- ⁷ Bull. M. C. Z., Vol. L., No. 4, November, 1906, 26 pp., 4 pls.
- ⁸ Mem. M. C. Z., Vol. XXXV., No. 1, February, 1907, 20 pp., 15 pls.
- ⁹ Bull. M. C. Z., Vol. L., No. 6, February, 1907, 48 pp., 18 pls.
- ¹⁰ Mem. M. C. Z., Vol. XXXV., No. 2, August, 1907, 56 pp., 9 pls.
- ¹¹ Bull. M. C. Z., Vol. LI., No. 6, November, 1907, 22 pp., 1 pl.
- ¹² Bull. M. C. Z., Vol. LII., No. 1, June, 1908, 14 pp., 1 pl.
- ¹³ Bull. M. C. Z., Vol. LII., No. 2, July, 1908, 8 pp., 5 pls.
- ¹⁴ Bull. M. C. Z., Vol. XLIII., No. 6, October, 1908, 285 pp., 22 pls.
- ¹⁵ Bull. M. C. Z., Vol. LII., No. 5, October, 1908, 11 pp., 2 pls.
- ¹⁶ Mem. M. C. Z., Vol. XXXVII., February, 1909, 243 pp., 48 pls.
- ¹⁷ Mem. M. C. Z., Vol. XXXVIII., No. 1, June, 1909, 172 pp., 5 pls., 3 maps.
- ¹⁸ Bull. M. C. Z., Vol. LII., No. 9, June, 1909, 26 pp., 8 pls.
- ¹⁹ Bull. M. C. Z., Vol. LII., No. 11, August, 1909, 10 pp., 3 pls.
- ²⁰ Bull. M. C. Z., Vol. LII., No. 13, September, 1909, 48 pp., 4 pls.
- ²¹ Mem. M. C. Z., Vol. XLI., August, September, 1910, 323 pp., 56 pls.
- ²² Bull. M. C. Z., Vol. LIV., No. 7, August, 1911, 38 pp.
- ²³ Mem. M. C. Z., Vol. XXXVIII., No. 2, December, 1911, 232 pp., 32 pls.
- ²⁴ Bull. M. C. Z., Vol. LIV., No. 10, February, 1912, 16 pp., 2 pls.
- ²⁵ Mem. M. C. Z., Vol. XXXV., No. 3, April, 1912, 98 pp., 8 pls.
- ²⁶ Bull. M. C. Z., Vol. LIV., No. 12, April, 1912, 38 pp., 2 pls.
- ²⁷ Mem. M. C. Z., Vol. XXXV., No. 4, July, 1912, 124 pp., 12 pls.
- ²⁸ Bull. M. C. Z., Vol. LVIII., No. 8, August, 1914, 14 pp.
- ²⁹ Mem. M. C. Z., Vol. XLII., June, 1915, 397 pp., 109 pls.
- ³⁰ Bull. M. C. Z., Vol. LXI., October, 1917, 28 pp., 5 pls.
- ³¹ Mem. M. C. Z., Vol. XLVIII., July, 1919, 514 pp., 80 pls.
- ³² Mem. M. C. Z., Vol. XXXIX., No. 3, February, 1920, 46 pp., 6 pls.
- ³³ Mem. M. C. Z., Vol. XXXIX., No. 4, September, 1920, 40 pp., 4 pls.

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REPORT.

TO THE PRESIDENT AND FELLOWS OF HARVARD COLLEGE:—

DURING the Academic year 1920–1921 most of the instruction and the facilities for research in Zoölogy, Geology, and Geography offered in Harvard University and in Radcliffe College were given in the Lecture Rooms and Laboratories of the Museum.

In Zoölogy fifteen courses or half courses were taken by 395 students in Harvard University and eleven courses or half courses were taken by 90 students in Radcliffe College.

In 1919–1920 these courses and students were: —

Harvard:— 16 courses, 317 students.

Radcliffe:— 7 courses, 88 students.

In Geology and Geography twenty-three courses or half courses were taken by 523 students in Harvard University and six courses or half courses were taken by 67 students in Radcliffe College.

In 1919–1920 these courses and students were: —

Harvard:— 30 courses, 504 students.

Radcliffe:— 8 courses, 126 students.

Through the kind interest of Prof. Theodore Lyman, Dr. G. M. Allen was enabled to work for two weeks among the Uinta mountains, Utah, where he secured small series of several desirable mammals and birds.

In furtherance of his ornithological studies and in the interest of the Museum collections, Dr. John C. Phillips sent Mr. James L. Peters to Argentina. Mr. Peters completed a year's field-work in June, 1921, and his collections thus far received comprise about 200 skins and skulls of small mammals, 1,250 bird skins, and a series of reptiles and amphibians. Dr. Phillips also coöperated with the U. S. Biological Survey in the Survey's field-work in Alberta and Saskatchewan, whereby the Museum has received 186 skins and skulls of mammals and 483 skins of birds.

Working in a Pleistocene deposit near Palm Beach, Florida, Dr. Thomas Barbour secured the remains of many vertebrates, the

more striking being those of two species of elephant and a very large chelonian.

Mr. E. R. Dunn, owing to the generosity of Dr. Thomas Barbour, spent several weeks in field-work in Costa Rica. He secured a large and interesting series of reptiles and amphibians, and several specimens of two species of *Peripatus*.

During June and July, Dr. R. V. Chamberlin resumed his field-work in Utah, and secured a large number of arachnids and myriopods; these, with those taken in former years, make the Museum's collections of Arachnida and Myriopoda from western North America the largest extant.

The exploration of the Gulf of Maine which the U. S. Bureau of Fisheries and the Museum have carried on in coöperation for the past ten years, under the direction of Dr. H. B. Bigelow, was continued, and during December, 1920, January and March, 1921, the U. S. Fisheries Steamer HALCYON cruised in the northern part of the Gulf of Maine. With this year's observations, data has been obtained from cruises undertaken during every month of the year, and Dr. Bigelow is preparing a detailed summary of the results. As in previous years, Dr. Bigelow has also had the direction of the scientific results obtained by the U. S. Coast Guard Steamer SENECA, during the ice patrol of the Grand Banks.

Prof. P. E. Raymond's field-work in Quebec, New York, and Maine, was unusually successful. Large and interesting collections were made; some of the fossils obtained were unequalled in quality, others were from localities not usually accessible; an old Devonian locality on the River St. Andre, Quebec, was rediscovered, and a large collection of corals secured.

Dr. Thomas Barbour's generosity to the Museum, apart from his unconventional gifts to the collections under his charge, has been very great; one of the largest and most valuable of his gifts this year is the A. P. Morse collection of insects, a collection of more than 50,000 specimens, with numerous types, chiefly among the Orthoptera. To the collections of mammals and birds Dr. Barbour has given, as in previous years, many species new to the collections and especially selected for their rarity, to complete series, or to further some special need; the beautiful series of nearly 1,800 species of Japanese shells (Hirase collection), added to two

earlier gifts of Dr. Barbour, gives the Museum a very serviceable representation of the shells of the Japanese province.

A gift of great scientific value has been received from the Peabody Museum of Yale University through Prof. Charles Schuchert. It consists of a series of specimens of a trilobite, *Triarthrus becki* Green, showing appendages; these specimens are a part of the original set prepared and studied by Prof. C. E. Beecher, and are, according to Professor Schuchert, in completeness and value secondary only to the series at Yale.

The Museum is greatly indebted to Mr. Arthur F. Gray for the gift of his collection of shells, an enormous series of several million specimens, the accumulation of a life-time of a close student and zealous collector. Mr. Gray's studies were associated with the work of many conchologists, and his collection contains a large amount of original material from the collections of W. G. Binney, Thomas Bland, and James Lewis, three distinguished students of the land shells of the United States and the Antilles.

The Museum is likewise indebted to Col. John E. Thayer for a beautiful series of mammals from New Mexico, California, and Victoria Land, and for a similar series of reptiles and amphibians from New Mexico; to Mr. Charles P. Curtis for a collection of mammals and birds from British East Africa; to Mr. T. E. Penard for a number of birds from Surinam; to Prof. H. W. Smith for a large and well-preserved collection of reptiles from Sarawak; to Prof. J. B. Woodworth for the type of *Dromopus woodworthi* Lull; to Prof. W. M. Wheeler for a collection of Chinese ants, including the types of new species, and for a number of interesting insects from British Guiana; and to Dr. William Barnes for several types of Plume-moths, Pterophoridae.

Of other accessions the following may be noted: —

From Dr. J. C. Phillips, a fine head (mounted) of Père David's Deer; from the Rev. George Schwab, a considerable series of bird skins and fresh-water fishes; from the Raffles Museum, bird skins from Sarawak; from Mr. C. T. Ramsden, a collection of Cuban fishes; from Stanford University, through Chancellor *emeritus* D. S. Jordan, a slab of diatom rock showing *Xyne grex* Jordan and Gilbert, a Miocene representative of the Herrings; from Mr. B. P. Clark, a number of Sphingidae new to the collec-

tion; from Mr. E. B. Williamson, a series of Odonata; from Mr. G. E. Cabot, fossil shells from California; from the Bermuda Biological Station, Dr. E. L. Mark, Director, a large number of marine invertebrates; from the U.S. National Museum, collections of Cynipidae and echinoderms; and from the Institut Océanographique (Monaco), a collection of echinoderms.

A holographic copy, dated Nov. 12, 1860, of Longfellow's well-known poem, "The fiftieth birthday of Agassiz," has, through the kindness of Mrs. George R. Agassiz, been added to the Museum's *memorabilia*.

The reports of the Curators give the details of the work accomplished, and of the conditions of the collections in their charge.

In his work upon the collections of mammals, Dr. G. M. Allen has recorded the accession of over 800 specimens, and has added some 3,700 entries, chiefly fossils, to the card catalogue. He has rearranged much of the osteological part of the collection, and developed and identified considerable fossil material. The skeletal parts of the Indian Elephant, "MOLLY," from the Franklin Park Zoölogical Garden, the gift of the City of Boston, to which the Museum is already under obligation for important additions to its collections, were prepared by Dr. Allen and Mr. Nelson with the efficient aid of the N. Ward Company.

The accessions to the collections of recent mollusks upon which Mr. W. F. Clapp has been engaged throughout the year, have been many and important. Valuable collections, not already mentioned, include an extensive series of operculate land shells received from the Boston Society of Natural History, and smaller series from Guatemala and the Canal Zone, the gifts of Messrs. A. Hinkley and James Zetek. These collections and the Hirase shells, Dr. Barbour's gift, consist very largely of species new to the Museum. In addition to his routine work upon the collection, Mr. Clapp has completed a report upon the shells obtained by Dr. W. M. Mann among the Solomon Islands.

Dr. R. T. Jackson's services were engaged for a part of the year, during which he reidentified and labeled a portion of the collection of fossil Echini.

The scope of Mr. George Nelson's work, as Preparator, varies very little from year to year, but the receipt of new material in the

flesh and the call for his services in the preparation or development of material, new and old, to aid the studies of the several Curators or of investigators elsewhere, not infrequently delays the completion of specimens for exhibition. Two of the more noteworthy prepared this year are a Manatee obtained in 1919 at Sebastian, Fla. by Mr. Nelson himself, and an especially fine Sail-fish, *Istiophorus nigricans* (Lacépède) taken off Long Key, Fla. by Mr. George R. Agassiz.

After Mr. Nelson's masterly remount of the Audubon Great Auk, mentioned in last year's Report, Dr. Sanford's wish that the "Naylor" Great Auk and two Labrador Ducks should be entrusted for remounting to the same competent hands was but natural, and in placing Mr. Nelson's time and skill at his disposal, the Museum had a genuine satisfaction, due to the exceptional scientific value of the birds, and to Dr. Sanford's liberality in allowing the Museum to share in the results of his well-directed and successful work for the promotion of ornithological exploration.

For the voluntary work of Miss Elizabeth B. Bryant and Mr. T. E. Penard the Museum is greatly indebted.

The Library contains 58,639 volumes, and 62,145 pamphlets; 1,225 volumes and 2,159 pamphlets have been received during the year.

The publications for the year include two numbers of the Memoirs, five numbers of the Bulletin, and the Annual Report, a total of 438 (144 quarto, and 294 octavo) pages, illustrated by 41 (32 quarto, and 9 octavo) plates. One number of the Memoirs contains the Report on the Holothurians collected during the expeditions of the U. S. Fisheries Steamer ALBATROSS in the Tropical and Eastern Tropical Pacific, during the years 1899-1900 and 1904-1905. This Memoir completes the reports on the ALBATROSS echinoderms. The other Memoir contains the third part of Dr. C. H. Eigenmann's account of the American Characidae. All five Bulletins are based upon Museum collections.

The Museum suffered a severe loss in the death of Walter Faxon, which occurred at Lexington, 10 August, 1920. Associated with the work of the Museum for nearly fifty years, Dr. Faxon's curatorial charge of the Crustacea and Mollusca gives an all too inadequate indication of his services and of the breadth and extent

of his knowledge. A chief authority on certain groups of the Crustacea, unexcelled as a field naturalist, Dr. Faxon was an admirable type of the scholarly man of science. He gained and retained the confidence of his associates to a remarkable degree; on taxonomic and nomenclatorial questions the soundness of his conclusions and the clarity of his explanations were most convincing. Dr. Faxon bequeathed his books and pamphlets on zoölogy, palaeontology, and geology to the Museum. Only a small part of this bequest, 399 titles, has been catalogued and added to the Museum's shelves, and though very many of the ornithological works have been forestalled by the William Brewster bequest, the Faxon duplicates will, through our system of exchanges, associate his name with many future accessions. Dr. Faxon's bequest contains a unique and probably unequalled collection of the writings, scientific and literary, of Alexander Wilson.

SAMUEL HENSHAW,
Director.

REPORT ON THE ZOÖLOGICAL LABORATORY.

BY E. L. MARK.

The courses in Zoölogy for the year 1920-1921 were given by the same instructors as in the previous year, with the exception of Zoölogy 1, which was conducted by Professor Brues. Professor Parker was away during the second half-year, having been appointed Exchange Professor at one of the groups of western colleges; he was resident for one month each at the following colleges: Grinnell, Colorado, and Pomona.

The number of students who attended the several courses is given, as in previous years, by schools and classes in the form of tables. Table I gives the numbers of students in Harvard University, and Table II of those in Radcliffe College.

TABLE I.

| Courses 1920-1921 | Graduates | | Educ. | Sen. | Jun. | Soph. | Fresh. | Unc. | Occ. | Sp. | Engin. | Total |
|----------------------|-----------|---------|-------|------|------|-------|--------|------|------|-----|--------|-------------------|
| | A. & S. | Ap. Sc. | | | | | | | | | | |
| Zoölogy 1 | 3 | 1 | — | 13 | 32 | 50 | 61 | 24 | 4 | 10 | 1 | 199 |
| " 3 | 3+2 | — | — | 3 | 11 | 9 | 9 | 10 | — | 7 | — | 52+2 |
| " 4 | +1 | — | — | — | 5 | 3 | — | 10 | 1 | 4 | — | 23+1 |
| " 5 <i>b</i> | 4+2 | — | 1 | — | 3 | 2 | — | 4 | — | 2 | — | 16+2 |
| " 7 <i>a</i> | 3 | 2 | — | — | 2 | 1 | — | 1 | — | — | — | 9 |
| " 7 <i>b</i> | 2 | 2 | — | — | 2 | — | — | 1 | — | — | — | 7 |
| " 8 | — | — | — | 9 | 30 | 8 | — | 8 | 2 | — | 1 | 58 |
| " 14 <i>a</i> | 4 | — | — | 2 | 3 | — | — | 3 | — | — | — | 12+6 ² |
| " 17 | 2 | — | — | 2 | 2 | — | — | 1 | — | — | — | 7 |
| " Sp. ¹ | 1 | — | — | — | — | — | — | — | — | — | — | 1 |
| " 20 <i>a</i> | 1 | — | — | — | 1 | — | — | — | — | — | — | 2 |
| " 20 <i>b</i> | 1 | — | — | — | — | — | — | — | — | — | — | 1 |
| " 20 <i>c</i> | 3 | — | — | — | — | — | — | — | — | — | — | 3 |
| " 20 <i>e</i> | 2 | — | — | — | — | — | — | — | — | — | — | 2 |
| " 20 <i>g</i> | 2 | — | — | — | 1 | — | — | — | — | — | — | 3 |
| Sums | 31+5 | 5 | 1 | 29 | 92 | 73 | 70 | 62 | 7 | 23 | 2 | 395+11 |

Note: Numbers in italics refer to students attending the lectures, but not enrolled in the course.

¹ Special research under Dr. Thomas Barbour.

² Not recorded by schools and classes.

TABLE II

| Courses 1920-1921 | Gr. | Sen. | Jun. | Soph. | Fresh. | Unc. | Sp. | Total |
|----------------------|-----|------|------|-------|--------|------|-----|------------------|
| Zoölogy 1 | 1 | 4 | 7 | 9 | 7 | 6 | 1 | 35 |
| " 2 | 2 | 6 | — | 2 | — | 1 | — | 11 |
| " 3 | 1 | — | 1 | 4 | — | 3 | — | 9 |
| " 4 | — | 1 | 3 | 1 | — | 1 | — | 6 |
| " 5b | 1 | 3 | — | 1 | — | 1 | — | 6 |
| " 7 | — | 2 | 2 | 2 | — | — | — | 6 |
| " 12 | — | 3 | — | — | — | — | — | 3 |
| " 14a | — | 5 | 2 | — | — | — | — | 7+2 ¹ |
| " 17 | — | 4 | — | — | — | — | — | 4 |
| " 20e | — | 2 | — | — | — | — | — | 2 |
| " 20g | — | 1 | — | — | — | — | — | 1 |
| Sums | 5 | 31 | 15 | 19 | 7 | 12 | 1 | 90+2 |

The assistants in the courses were: Zoölogy 1, *Harvard*: chief-assistants, Messrs. W. H. Cole and A. S. Gilson, Jr., sub-assistants, Messrs. E. S. Anderson, R. Bennitt, and R. F. Hussey; *Radcliffe*: assistants, Messrs. E. R. Dunn and R. F. Hussey. Zoölogy 3, *Harvard*: chief-assistant, Mr. R. Bennitt, sub-assistant, Mr. A. E. Longley; *Radcliffe*: assistant, Mr. E. R. Dunn. Zoölogy 4, *Harvard*: assistant, Mr. L. C. Wyman; *Radcliffe*: assistant, Mr. F. B. Manning. Zoölogy 5b, *Harvard* and *Radcliffe*: assistant, Mr. L. C. Wyman. Zoölogy 12, *Radcliffe*: assistant, Mr. L. C. Wyman.

All courses, except 7a and 7b,—given at the Bussey Institution,—were given in Cambridge. Three Harvard students took Zoölogy 14a as a thesis course, nine as a laboratory course; and of the Radcliffe students five took it as a thesis course, two as a laboratory course.

The Extension course in elementary Zoölogy was given by Professor Parker in the first half-year to fifteen students, eight of whom took the examination. Mr. A. S. Gilson, Jr. was the assistant in the course.

During the first half-year Dr. Ann Morgan of Mt. Holyoke College, a guest of the laboratory, worked under the direction of

Not recorded by schools and classes.

Professor Parker on the senses of the frog's skin. Other research work carried on in the department was counted as equivalent to courses as follows:— In Harvard, Zoölogy 20*a* and 20*b*, under Professor Mark, one and one-half courses; Zoölogy 20*c*, under Professor Parker, three courses; Zoölogy 20*e* and 20*g*, under Associate Professor Rand, five and one-half courses; under Dr. Thomas Barbour, two and one-half courses; in Radcliffe College, Zoölogy 20*e* and 20*g* under Associate Professor Rand, one and one-half courses.

The degree of Doctor of Philosophy was conferred in February 1921, on Samuel Wood Chase, the subject of whose thesis was given in the report for 1919–20, and in June, 1921, on Herbert Greenleaf Coar, whose thesis was on The shell of *Balanus eburneus*: a contribution to the study of the operculate Cirripedia.

The Bermuda Biological Station was open from the eighth of July till the fifteenth of August. Including the Director, there were in attendance the whole or a part of the time seven investigators, five of whom were, or had been, students in Harvard University or Radcliffe College.

The Harvard Table at the Marine Biological Laboratory, Woods Hole, was shared by two graduate students, that of Radcliffe College was occupied by one graduate student.

Financial assistance to the amount of \$270.00 was given from the Humboldt Fund to Harvard research students at the Bermuda Station and the Woods Hole Laboratory, but the payments fall within the fiscal year 1921–22.

The Zoölogical Club held twenty-three meetings during the year at which twenty-two original papers and seven reviews were presented. The average attendance was nineteen. Mr. S. W. Chase was the secretary.

The Contributions from the Zoölogical Laboratory and from the Bermuda Biological Station for Research for the year 1920–1921 are listed on p. 32–33; other papers under the authors' names.

REPORT OF THE STURGIS HOOPER PROFESSOR OF GEOLOGY.

BY REGINALD A. DALY.

During the year the writer continued to act as Chairman of the Department of Geology and Geography, as instructor in charge of Geology 4, and as the conductor of research in Geology 20c. The time was chiefly spent on investigations regarding the earth's thermal gradient, elasticity, and viscosity; on the strength of the earth's crust; on the nature and amount of the tangential stresses affecting the crust; and on the distribution of densities within the earth. These studies have led to the conclusion that the theory of mountain-building should take serious account of the new Taylor-Wegener hypothesis of continental creep. A manuscript on the subject has been written, but further work is needed before it can be published. Some results of the investigation were presented before the Geological Society of Washington.

On July 2nd the writer sailed for England, to pursue certain field studies on the geology of Great Britain and, as Director of the projected Shaler Memorial Expedition to South Africa, to complete arrangements for the transportation of the party and for its equipment.

The writer continued to serve as a member of the Division of Geology and Geography in the National Research Council, and as a member of the American Geophysical Union, meetings of which were attended at Washington. In the May number of the American journal of science, a paper was published on the Postglacial warping of Newfoundland and Nova Scotia.

REPORT ON THE DEPARTMENT OF GEOLOGY AND GEOGRAPHY.

BY J. B. WOODWORTH.

Professor Daly served as Chairman of the Department until July 1st, when the writer assumed charge.

Except in the geographical section, the personnel of the Department was the same as last year. The professorship in physiography has not been filled. Mr. N. E. A. Hinds was appointed instructor in elementary geology and physiography, and Mr. T. H. Clark instructor in geology. Thus, for the first time in many years, the Department has had the advantage of having some of its instruction given by experienced men of grade intermediate between that of a professor and that of an assistant. Professor Graton was absent during the first half-year, his courses being efficiently conducted by Dr. A. Wandke. Mr. F. G. Clapp generously gave his services as lecturer on oil geology.

Foxcroft House was fitted up for the use of the section of economic geology, the transfer from Pierce Hall being necessitated by the reoccupation of the hall by the Engineering School.

The number of enrollments of students in each course is given in the following table.

Harvard:

| | | | | |
|---------|------------------|---|--|-----|
| Geology | 4 | — | Professor Daly; Messrs. Gilbert, Hines, & Swinnerton . | 157 |
| " | 5 | — | " Woodworth; Mr. Clark | 85 |
| " | 8 | — | " " | 15 |
| " | 10 ¹ | — | Professors Smyth & Graton | 20 |
| " | 11 ¹ | — | Professor " | 4 |
| " | 12 | — | " Woodworth; Mr. Clark | 11 |
| " | 13 ¹ | — | " Smyth | 13 |
| " | 16 | — | " Woodworth | 22 |
| " | 18a ¹ | — | Professors Wolff & Palache | 5 |
| " | 18b ¹ | — | Professors Graton & Jeffrey | 38 |

¹ Included in the Report for 1919-1920, the first time in recent years.

Harvard:

| | | | | |
|---------------|-----|---|--------------------------------------|-------|
| Geology | 20c | — | Professor Daly | 2 |
| " | 20e | — | " " Woodworth | 2 |
| " | 20f | — | " " | 1 |
| Geography | 1 | — | Messrs. Hinds & James | 35 |
| Meteorology | 1 | — | Professor Ward; Mr. French | 62 |
| " | 2 | — | " " | 5 |
| " | 3 | — | " " | 5 |
| " | 4 | — | " " | 3 |
| " | 20 | — | " " | 1 |
| Palaeontology | 1 | — | " Raymond; Mr. Bradley | 23 |
| " | 2 | — | " " | 6 |
| " | 3 | — | " " | 4 |
| " | 20 | — | " " | 4 |
| | | | | <hr/> |
| | | | | 523 |

Radcliffe:

| | | | | |
|---------------|---|---|--|-------|
| Geology | 4 | — | Professor Woodworth; Mr. Smith | 26 |
| " | 5 | — | " " | 5 |
| Meteorology | 1 | — | " Ward | 21 |
| " | 2 | — | " " | 3 |
| " | 3 | — | " " | 3 |
| Palaeontology | 1 | — | " Raymond | 9 |
| | | | | <hr/> |
| | | | | 67 |

Students in the Engineering School, registered in the course in geological surveying, take only the field-work in the fall and spring, attending an hourly conference once a week for about twelve weeks.

Two students were enrolled in field-work in the Summer School of 1921, Mr. Allyn C. Swinnerton working in Vermont, Mr. P. W. K. Sweet in Maine; Mr. E. S. C. Smith, graduate student, also worked in Maine, but without enrollment in the School. Professor Woodworth visited Messrs. Smith and Sweet at East Brownfield, Maine, in August.

Professor Woodworth continued the registration of earthquakes by the Harvard Seismograph and the decipherment of the records.

Professor Woodworth gave an unusual amount of time to consultations with federal and state officers concerning the geology of the eastern part of Massachusetts with special reference to soils, the location of concealed minerals or metals which might account for certain anomalies in radio transmission on the coast,

and other problems in which a knowledge of the local geology is a factor in the working out of a solution. Two days were spent in July in an examination of the lower course of the Connecticut River between Middletown and Saybrook, as well as in a visit to Haddam and vicinity, in an attempt to determine the possible association of the well-known slight earthquakes of that district with recent faults. No signs of Postglacial faulting of the bed-rock were discovered. Some progress was made in gathering materials for a comprehensive paper on the relation of folded chains to fault-block mountains.

Mr. Harold C. Durrell gave a set of the publications of the U. S. G. S., and Lieut. John L. Pultz has deposited a wireless receiving set for the purpose of obtaining time signals for the Seismographic Station. It is hoped that this service, when working, will relieve the Astronomical Observatory of our almost daily request for a comparison of the rate of our seismographic service clock, a service most generously given for the past ten years.

In addition to his regular courses, Professor Ward gave a series of sixteen lectures on tropical climatology to the graduate students in the School of Tropical Medicine of the Harvard Medical School. On May 9th, he gave a lecture on Meteorology in relation to the art of war at the General Staff College, Washington Barracks, D. C. As President of the American Meteorological Society, Professor Ward gave an address on Climate and health, with special reference to the United States, in Chicago, December 29, 1920; and presided at the winter and spring meetings of this Society, of which he was reëlected President for the year 1921. In April, he attended the meetings of the American Geophysical Union in Washington. Spare time during the winter was devoted to further work on a book dealing with the climates of the United States. This work was continued during the summer. The teaching collections in meteorology and climatology have been improved by the addition of some thirty photographic enlargements.

Professor Raymond continued his investigations of the stratigraphy of the Ordovician of the southern Appalachians, under a grant from the Shaler Memorial Fund. Two months were spent in studying localities in Virginia, Tennessee, Alabama, and Ken-

tucky, completing the work begun in 1917 and 1918. A large amount of information and a representative collection of fossils were secured. Professor Raymond was accompanied by Dr. Gustav F. Troedsson of the University of Lund, Sweden.

Results of work done in Palaeontology 20 were published by Mr. J. H. Bradley and Mr. T. H. Clark.

A Middle Cambrian crustacean and a worm were purchased, and a collection of fossils from Ohio was donated by Mr. R. F. Webb.

REPORT ON THE MAMMALS.

BY OUTRAM BANGS.

During the year, 837 specimens were received.

The most notable accessions are two collections, the gift of Dr. J. C. Phillips; both consist of well-made skins with skulls, and are from regions previously poorly represented in this Museum; the first, a series of 186 small mammals from Athabaska, and the second, about 200 specimens collected by Mr. J. L. Peters in Argentina.

Other important additions are:—Skins and alcoholics from New Mexico, California, and Victoria Land, (Col. J. E. Thayer); a collection from the Uinta Mountains, Utah, (Dr. Theodore Lyman); a collection from British East Africa, (Mr. C. P. Curtis); a skeleton of the European Beaver, skin and skull of the Florida Black Bear, skull of Florida White-tailed Deer, collections from Arizona and southern Texas, and twenty specimens especially selected to fill lacunae; also a considerable series of bones from a Pleistocene deposit near Palm Beach, Florida, (Dr. Thomas Barbour). Single specimens or small series have been received from Messrs. G. M. Allen, E. A. von Armin, A. M. Banta, W. E. Castle, G. A. Holman, A. B. Howell, H. H. Johnson, R. C. Murphy, George Nelson, G. K. Noble, A. S. Roamer, George Schwab, and J. N. Sullivan.

Exchanges have been made with the Queensland Museum and with the Bâle Museum.

REPORT ON THE BIRDS.

BY OUTRAM BANGS.

During the year, 2,666 specimens were received.

The most important addition, 1,250 skins collected in Argentina, by Mr. J. L. Peters, is due to the generosity of Dr. J. C. Phillips. The other larger collections are:—one of 483 skins, from Saskatchewan and Alberta, including fine series of breeding ducks and downy young, made by Mr. F. Harper and others, also the gift of Dr. Phillips; 354 skins made by Mr. C. P. Curtis in East Africa, and containing many species and two genera not previously represented in our collection; one of 64 skins from Surinam, presented by Mr. T. E. Penard and Mr. Outram Bangs; one of 37 skins of Sarawak birds, presented by Mr. J. C. Moulton, on account of the Raffles Museum; one of 25 skins from Mt. Baldy, Utah, including a series of breeding specimens of *Leucosticte atrata* Ridgway, presented by Prof. Theodore Lyman; and by purchase from Rev. George Schwab, a fine lot of 139 skins from Cameroun.

Small lots and single specimens have been presented by Messrs. Outram Bangs, Thomas Barbour, Samuel Henshaw, R. H. Howe, Jr., George Nelson, T. E. Penard, J. C. Phillips, Roland Thaxter, J. E. Thayer, and H. B. Washburn.

By exchange, 245 skins have been acquired.

During the year, 24 genera, not before represented in the collection, have been added.

A large number of specimens have been loaned to institutions and individuals.

Messrs. T. E. Penard and F. H. Kennard have assisted in the work of the Department.

REPORT ON THE REPTILES AND AMPHIBIANS.

BY THOMAS BARBOUR.

The year has been singularly fortunate in that decidedly more than the usual amount of material has been received.

Dr. G. M. Allen has card catalogued all of the Salientia, so that now all of the study material is so indexed, except the Chelonia and some of the material in the tanks.

Mr. E. R. Dunn returned from Costa Rica with a rich collection, and after a year spent in completing his Revision of the free tongued salamanders, a thesis for the Doctorate of Philosophy, he sailed in June for Vera Cruz for field-work in southern Mexico.

I spent most of the mid winter in Florida, principally collecting vertebrate fossils, with rather mediocre success.

The W. S. Blatchley collection was added to the study series during the year; other material was received by purchase from Yunnan, the Huachuca Mountains, Texas, and East Africa. Col. J. E. Thayer presented a collection from Las Cruces, New Mexico, while Prof. H. H. Wilder presented a valuable Chinese urodele.

Prof. Harrison H. Smith has collected a large and well-preserved group of specimens from several districts in Sarawak previously unvisited by him. Brothers Nicéforo Maria and Apolinar Maria of Medellin and Bogotá have aided us in securing valuable Colombian collections.

Exchanges were completed with the following institutions:—Transvaal Museum, Queensland Museum, Instituto Oswaldo Cruz of Bello Horizonte, Minas Geraes, Brazil, British Museum, Leyden Museum, and various American institutions.

The material loaned Miss M. C. Dickerson many years ago has been returned.

During the year, we were favoured by welcome visitors to an exceptional degree; Dr. Ruthven, Dr. Van Denburgh, Mr. Blanchard, and Mr. Noble were among those who came to examine the collection.

REPORT ON THE FISHES.

BY SAMUEL GARMAN.

The principal additions for the year were made in a considerable purchase of freshwater forms, from especially desirable localities in the interior of Africa. Other additions were made from the Antilles, by Mr. C. T. Ramsden, from the Bermudas, by the Biological Station for Research, (Dr. E. L. Mark), and from the East Indies, by Dr. Thomas Barbour.

In the care of the collections, changes have been made on account of corrosion, evaporation, and fading labels. Determinations of present values, or of possible future utility, identifications, the histories of types, and other material studied or illustrated, have taken much attention; preparations and studies long continued, have been added to or revised, and throughout, a decrease in the amount of useless material has gone hand in hand with an improvement of what is retained.

REPORT ON THE ENTOMOLOGICAL DEPARTMENT.

BY NATHAN BANKS.

The most notable accession of the year is the A. P. Morse collection, containing about 50,000 specimens, largely Orthoptera, including numerous types and long series of many species. Besides the Orthoptera there is useful material, especially in the Hemiptera and Hymenoptera.

From Mr. J. Steinbach was obtained a large and valuable lot of Bolivian insects, Diptera, Hymenoptera, Hemiptera, and Neuroptera. Mr. E. B. Williamson has continued to send additions to the Odonata, and Dr. William Barnes, in naming our Pterophoridae, added some species, including paratypes. European Hymenoptera and Diptera, new to the collection, were purchased from Mr. Charles Sajo. Other material has come through the kindness of Messrs. C. F. Baker, Outram Bangs, W. S. Blatchley, W. S. Brooks, C. A. Frost, C. W. Johnson, Roland Thaxter, and W. M. Wheeler.

Mr. L. H. Weld, who carefully studied the Cynipidae, arranged an exchange with the National Museum, which increased this family to 365 species.

The condition of the collection is about as it has been for several years; the Ascalaphidae and Panorpidæ were arranged in new boxes. Over 3,000 types have been verified and marked; the Diptera contain 1,856 types, and the Neuroptera 2,150, of which 500 are Odonata.

About 4,000 specimens were pinned, and species labels attached to several thousand others. Nearly 500 Orthoptera were spread, and the Fiji insects repinned and spread. Various lots that were on loan have been returned, in some cases with additional species.

Besides the local entomologists, visitors to study the collection were exceptionally numerous:—J. Bequaert, Psammocharidae;

G. C. Crampton, Psocidae; E. T. Cresson, Jr., Ephydriidae; H. C. Fall and C. A. Frost, Coleoptera; W. T. Forbes, Lepidoptera; S. B. Fracker, Coreidae; A. B. Gahan, Braconidae; F. M. Gaige, Formicidae; Carl Heinrich, Tortricidae; P. B. Lawson, Jassidae; M. D. Leonard, Leptidae; F. Mason, Cicindelidae; S. Matsu-mura, Trichoptera; C. F. Muesbeck, Microgasters; A. Nicolay, Buprestidae; H. Notman, Carabidae; C. T. Ramsden, Hesperidae; W. S. Regan, Cerambycidae; W. D. Richardson, Parnidae; E. A. Richmond, Helophorus; S. A. Rohwer, Ichneumonidae; Carl Schaeffer, Donacia; T. E. Snyder, Termites; R. J. Tillyard, Neuroptera; R. Webber, Tachinidae; and Mr. and Mrs. L. H. Weld, Cynipidae and Chalcidae.

REPORT UPON THE MYRIOPODS, ARACHNIDS, AND
WORMS.

BY RALPH V. CHAMBERLIN.

During most of the year, work was continued upon the myriopods, particularly those of the National Museum collection. Material from the West Indies and Central America claimed the most time, and three papers were prepared as a result of its study. The Julidae and Isobatidae of North America were revised. Smaller collections were identified for various persons and institutions, scarcely a week passing without a call for service of this kind. Important lots received during the year, but not yet identified, were sent by the British Museum, the Raffles Museum at Singapore, E. Jacobson of Fort de Kock, Sumatra, C. F. Baker of the Philippines, and the California Academy of Sciences, the material received from the last named institution being that collected on the expedition of 1921 to the islands of the Gulf of California.

Work upon the arachnids was restricted to the identification of smaller lots. A short paper was prepared upon material collected in southern Utah by Prof. V. M. Tanner, who is continuing his collecting in that region, and one upon the Linyhiidae of St. Paul Island, Alaska. Part of June and July was spent in field-work in northern Utah, and in studying, in conjunction with Mr. J. C. Chamberlin, the latter's collection of California spiders. The spiders secured by the expedition of the California Academy of Sciences, previously mentioned, were received for report. A large collection of spiders made in Louisiana was received for study from Mr. H. E. Hubert.

Sipunculids were received for identification from the U. S. National Museum and from Miss M. Johnson.

For other material, the Museum is indebted to Messrs. G. G. Ainslie, J. C. Chamberlin, C. R. Crosby, W. A. Hilton, C. W. Howard, H. E. Hubert, A. G. Huntsman, M. D. Leonard, E. R. Sasscer, J. O. Snyder, and W. M. Wheeler.

REPORT ON THE ECHINODERMS.

BY HUBERT LYMAN CLARK.

For ten months of the year, I was absent on leave as acting Professor of Zoölogy at Williams College. During the other months, the work on the Museum collection of apodous holothurians, begun last year, was continued. The ALBATROSS collections belonging to the U. S. National Museum were labeled and packed for return.

The accessions for the year were numerous and valuable, amounting to more than 900 specimens of 185 species, of which 48 species and 11 genera are new to the collection. The chief sources of this new material were the U. S. National Museum, 250 specimens of 88 species, in return for identification of material; the Monaco Museum, 105 specimens of 36 species, in exchange; the Bermuda Biological Station for Research, 115 specimens of 15 species; Mr. D. Thaanum, of Hilo, Hawaii, 98 specimens of 15 Hawaiian species; and Miss Mildred Bush, 49 specimens of 9 species, from Puget Sound. Other donors, to whom thanks are due, were Profs. C. C. Engberg, W. A. Hilton, C. C. Nutting, and G. H. Parker, Drs. Thomas Barbour, W. K. Fisher, A. G. Mayor, and Th. Mortensen, Messrs. W. F. Clapp, F. Johansen, and W. M. L. Wilson, and the South African Museum.

REPORT ON THE COELENTERATES.

BY HENRY B. BIGELOW.

For accessions during the past year, thanks are due Prof. E. L. Mark, for Medusae and siphonophores from Bermuda, and to the Canadian Geological Survey, for Medusae from Hudson Bay. A series of samples of the Plankton trawls made by the ALBATROSS, in 1920, from the U. S. Bureau of Fisheries, should also be mentioned.

The oceanographic and biologic exploration of the Gulf of Maine, in which the Museum has coöperated with the U. S. Bureau of Fisheries since 1912, is now ripe for a comprehensive account of the results, and to this most of my time has been devoted throughout the year. To fill in gaps in the data, the U. S. Fisheries Steamer HALCYON, in my charge, cruised in the northern part of the Gulf from December 29th. to January 9th., and again during the first week in March, working 23 stations, at which 89 serial temperatures with salinity records, and 47 tow-net hauls were obtained.

It may be of interest to recapitulate that the total number of Gulf stations worked since 1912, basis for the forthcoming report, is about 350; of serial temperature records (usually with corresponding determination of salinity), 1,373; of tow-net hauls with the various nets, 1,016; and that longer or shorter cruises have been carried out during every month of the twelve, in one or other year, by the GRAMPUS, ALBATROSS, HALYCON, or BLUE WING.

Besides the Gulf of Maine work, I have, as in previous years, had general direction of the scientific program of the International ice-patrol of the Grand Banks, by the U. S. Coast Guard Steamer SENECA, February-June, Lieut.-Commander E. H. Smith and Mr. E. F. B. Fries respectively collecting the physical and biologic data.

As a result of negotiations between the United States and

Canadian governments, a permanent international committee on marine fishery investigations was established last January. Of this I was appointed a member, and on June 29th., attended its first meeting in Montreal, at which recommendations for the standardization of future hydrographic and plankton studies between the fishery services of the two governments were adopted.

During the past autumn, Prof. T. Kawamura, of the Imperial University, Kyoto, Japan, visited the Museum, and examined our series of agalmid siphonophores, in connection with his studies on Japanese representatives of this group.

REPORT ON INVERTEBRATE PALAEONTOLOGY.

BY P. E. RAYMOND.

Mr. T. H. Clark and the Curator spent two weeks in June of this year in collecting in Maine, Quebec, and New York. We were unusually fortunate in obtaining fossils at Quebec and Levis, from exposures which are seldom accessible, the suite from the Normanskill at Mountain Hill being the best ever obtained there. The old, almost forgotten locality in the Devonian, on the River St. Andre, Aubert de L'Isle, Quebec, was rediscovered, and a large and interesting collection of corals secured.

The chief work of the year was the beginning of the compilation of a bibliography of the genera of trilobites, toward which about 1,000 cards were prepared. In addition to this, the Chazy sponges of eastern North America were studied and described. Several new genera and species were founded on M. C. Z. specimens. A number of shorter papers was also written.

The Walcott collection of thin slices of trilobites was loaned to Dr. C. D. Walcott, who restudied it, had some of the sections ground thinner, and photographed a large number of them. A second collection of Cretaceous Bryozoa was loaned for study to Dr. Ray S. Bassler.

An unusually valuable gift received from the Peabody Museum of Yale University, through Prof. Charles Schuchert, consisted of a series of specimens of *Triarthrus becki*, showing appendages. These specimens formed a part of the original set prepared and studied by Prof. C. E. Beecher. In addition, a quantity of the material as it came from the quarry was also presented.

The accessions, other than those referred to above, have been as follows:—Donations — Mr. J. A. Noble, fossils from Montana; Dr. Sidney Powers, molluscan trails from Texas; Mr. Joseph T. Tower, Jr., Carboniferous fossils from Alaska; Mr. W. H. Bier-

inger, Triassic ammonite; Mr. A. C. Jewett, Devonian brachiopods from Maine; Mr. Alan S. Hays, Devonian corals from New York: Exchanges — University of Colorado, through Mr. N. E. A. Hinds, Pleistocene shells from California; Prof. E. W. Shuler, Southern Methodist University, Dallas, Texas, Ordovician and Cretaceous fossils from Colorado and Texas: Purchase — Three Devonian trilobites from Germany; six boxes of Ordovician fossils from Quebec, from Mr. T. H. Clark.

REPORT ON THE GEOLOGICAL COLLECTIONS.

BY R. W. SAYLES.

For the greater part of the past year the Curator has been absent from the Museum. A large number of labels have been renewed but few acquisitions made.

An examination was made of 79 microscopic slides of banded slates in the investigation of seasonal deposition. The slate specimens were collected last year by Mr. A. C. Swinnerton under the direction of the Curator, in northern Georgia, southeastern Tennessee, eastern New York, western Vermont, and Cobalt, Ontario. The Late Proterozoic or Lower Cambrian specimens collected from the Hiwassee slate in southeastern Tennessee show distinct seasonal characters, which resemble the characters of the seasonal layers of the Pleistocene and Permian glacial sediments. The banded slates of Lower Ordovician age in northern Georgia likewise show strong seasonal characters. Specimens of shale of the same age from Tennessee taken at Johnson City show the same characters. Specimens of presumably Lower Ordovician age collected at Melrose, N. Y. also show seasonal characters. The specimens of slate taken at Cobalt near the Huronian tillite show, as was expected, good seasonal characters.

During the coming year it is the purpose of the Curator to make a special collection of sediments to illustrate the different processes in the origin of the conglomerates, sandstones, and slates and shales.

REPORT ON THE LIBRARY.

During the Museum year from August 1, 1920, to July 31, 1921, inclusive, 1,225 volumes, 1,737 parts of volumes, and 2,159 pamphlets have been added to the Library.

The total number of volumes in the Library is 58,639, the total number of pamphlets is 62,145.

One hundred and ninety-six volumes have been bound; four thousand pamphlets have been separately bound.

The bequest of Walter Faxon, which constitutes the largest accession, contains some desirable works of travels and voyages and a large number of separates pertaining to carcinology and ornithology. A complete statement concerning the Faxon bequest will be given next year.

From the Harvard College Library, the Museum has received 531 titles; other contributors are Nathan Banks, (224 titles), Samuel Henshaw, (104 titles), Outram Bangs, (87 titles), Thomas Barbour, (85 titles), W. M. Davis, (71 titles), H. B. Bigelow, (30 titles), R. V. Chamberlin, (25 titles), and G. H. Parker, (21 titles).

PUBLICATIONS

FOR THE YEAR 1920-1921.

(1 AUGUST, 1920 — 31 JULY, 1921).

MUSEUM OF COMPARATIVE ZOOLOGY.

BULLETIN:—

Vol. LXIV.

- No. 3. New neuropteroid insects. By Nathan Banks. 66 pp. 7 plates. October, 1920.
- No. 4. Notes on some American birds, chiefly Neotropical. By Outram Bangs and Thomas E. Penard. 36 pp. January, 1921.
- No. 5. The ants of the Fiji islands. By W. M. Mann. 102 pp. February, 1921.
- No. 6. The Brachiopoda of the Maquoketa of Iowa. By John H. Bradley, Jr. 26 pp. 2 plates. April, 1921.
- No. 7. Chinese ants. By William Morton Wheeler. 21 pp. April, 1921.

MEMOIRS:

Vol. XXXIX.

- No. 4. Reports on the scientific results of the expedition to the Tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross," from August, 1899, to March, 1900, Commander Jefferson F. Moser, U. S. N., commanding. XXII. Reports on the scientific results of the expedition to the Eastern Tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission Steamer "Albatross," from October, 1904, to March, 1905, Lieut. Commander L. M. Garrett, U. S. N., commanding. XXXIII. Holothuriodea. By Hubert Lyman Clark. 40 pp. 4 plates. September, 1920.

Vol. XLIII.

- The American Characidae. By Carl H. Eigenmann. Pt. 3. 104 pp., 28 plates. July, 1921.

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- 1919-1920. 43 pp. December, 1920.
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CONTRIBUTIONS:—

322. ADOLPH, E. F.—Egg-laying reactions in the pomace fly, *Drosophila*. *Journ. exper. zool.*, October, 1920, **31**, p. 327–341.
323. PARKER, G. H.—Activities of colonial animals. I. Circulation of water in *Renilla*. *Journ. exper. zool.*, October, 1920, **31**, p. 343–368, 1 pl.
324. OLMSTED, J. M. D.—The results of cutting the seventh cranial nerve in *Amiurus nebulosus* (Lesueur). *Journ. exper. zool.*, November, 1920, **31**, p. 369–401, 4 pls.
325. PARKER, G. H.—Activities of colonial animals. II. Neuromuscular movements and phosphorescence in *Renilla*. *Journ. exper. zool.*, November, 1920, **31**, p. 475–516, 1 pl.
326. DAWSON, A. B.—The integument of *Necturus maculosus*. *Journ. morph.*, December, 1920, **34**, p. 487–589, 6 pls.
327. FULTON, J. F., Jr.—The controlling factors in amphibian metamorphosis. *Endocrinology*, January, 1921, **5**, p. 67–84.
328. WHEELER, G. C.—The phototropism of land snails. *Comp. psychol.*, April, 1921, **1**, p. 149–154.
329. PARKER, G. H.—The locomotion of the holothurian *Stichopus panimensis* [= *parvimensis*] Clark. *Journ. exper. zool.*, May, 1921, **33**, p. 205–208.
331. PARKER, G. H.—The power of adhesion in the suckers of *Octopus bimaculatus* Verrill. *Journ. exper. zool.*, July, 1921, **33**, p. 391–394.

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CONTRIBUTIONS:—

116. CROZIER, W. J.—Note on the photic sensitivity of the Chitons. *Amer. nat.*, July–August, 1920, **54**, p. 376–380.
117. CROZIER, W. J.—On the rôle of an integumentary pigment in photoreception in Holothuria. *Journ. gen. physiol.*, September, 1920, **3**, p. 57–60.
118. CROZIER, W. J.—Notes on the bionomics of *Mellita*. *Amer. nat.*, September–October, 1920, **54**, p. 435–442.

120. CROZIER, W. J.—Notes on some problems of adaptation. 1.
On the re-formation of the mantle-glands of *Chromodoris*.
Biol. bull., August, 1920, **39**, p. 108–115.
121. CROZIER, W. J.—Notes on some problems of adaptation. 2.
On the temporal relations of asexual propagation and
gametic reproduction in *Coscinasterias tenuispina*: with a
note on the direction of progression and on the significance of
the madrepores. *Biol. bull.*, August, 1920, **39**, p. 116–129.
122. CROZIER, W. J.—Notes on some problems of adaptation. 3.
The volume of water involved in the cloacal pumping of
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p. 130–132.
123. FULTON, J. F., Jr.—The catalytic properties of the respiratory
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124. FULTON, J. F., Jr.—See *supra*, *Contrib. Zool. Lab.*, **327**.
125. FULTON, J. F., Jr.—The blood of *Ascidia atra* Lesueur; with
special reference to pigmentation and phagocytosis. *Acta*
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